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AMENDMENTS TO THE SPECIFICATION

Please replace the paragraph beginning on page 1, line 5 as follows:

The present ~~invention~~ disclosure generally relates to multi-access communication systems based on the Internet Protocol (IP) and in particular to ~~a method~~methods and apparatuses for access selection in such systems.

Please replace the paragraph beginning on page 3, line 23 as follows:

~~A general object of the present invention is to provide~~In an aspect of the disclosure, an improved method for access selection in IP-based multi-access networks. A specific object is to enable optimized access selection for end users in multi-access networks. Another object is to provide an access selection mechanism suitable for overall multi-access solutions like ABC mechanisms. Still another object is to provide an access selection mechanism suitable for vehicular scenarios.

Please replace the paragraph beginning on page 3, line 30 as follows:

~~These objects are achieved in accordance with the attached claims.~~

Please replace the paragraph beginning on page 3, line 32 as follows:

Briefly, ~~the present invention proposes~~it is proposed that the access selection be performed at the network side in order to connect a mobile terminal with multiple access possibilities to the best IP access network. The

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access network concept can in this context e.g. be based on technology, owner/operator or geography. The network-based access selection is achieved by an access wizard unit, communicating with a profile server, which provides a unified interface to a number of databases in the network. Via the profile server, the access wizard unit collects database information, such as access network properties, operator policies, operator/user prioritization criteria and allowed user subscription profiles based on which it determines a "best" access network. Preferably, the access selection at the access wizard unit is also based on terminal specific information, such as current terminal location and available access networks, received from an access wizard agent in the mobile terminal. A recommendation/indication of the best access is signaled from the access wizard unit to the access wizard agent, and then to an access manager in the terminal associated with means for connecting the best access network.

Please replace the paragraph beginning on page 4, line 16 as follows:

~~The~~ An example access selection method ~~of the present invention~~ contributes to make it possible for users to always be connected to the best access network. The proposed solution enables well-founded access decisions, since many factors related to the user and terminal as well as to the access networks and operators can be considered. The network-based access selection also offers an overall perspective, ~~by means of~~through which network resources can be better used. Another advantage of the access selection of the

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invention is that it is capable of handling large data quantities and heavy computations.

Please replace the paragraph beginning on page 4, line 25 as follows:

In ~~a preferred~~an embodiment ~~of the invention~~, it is the access manager that performs the final decision as for which access network to use based on the recommendation from the access wizard unit, possibly together with user input and/or a priority list in the terminal. This can be useful e.g. in case the access network selected by the access wizard unit has changed or is down.

Please replace the paragraph beginning on page 5, line 6 as follows:

In accordance with other advantageous embodiments ~~of the invention, it is suggested that~~, the access wizard unit assists the security infrastructure for achieving seamless mobility and that applications are adapted at network level (on the network side) through support from the profile server.

Please replace the paragraph beginning on page 5, line 11 as follows:

According to other aspects ~~of the invention~~, a server device, a communication system and a mobile terminal with means for access selection are provided.

Please replace the paragraph beginning on page 5, line 20 as follows:

Fig. 1 is a schematic view of ~~a~~ an example multi-access communication system ~~in which the present invention can be used~~;

Please replace the paragraph beginning on page 5, line 23 as follows:

Fig. 2 is a schematic block diagram of a multi-access communication system ~~with~~ for access selection ~~means~~ according to a first ~~exemplary~~ embodiment ~~of the present invention~~;

Please replace the paragraph beginning on page 5, line 27 as follows:

Fig. 3 is a schematic block diagram of a multi-access communication system ~~with~~ for access selection ~~means~~ according to a second ~~exemplary~~ embodiment ~~of the present invention~~.

Please replace the paragraph beginning on page 5, line 31 as follows:

Fig. 4 is a schematic block diagram of a multi-access communication system ~~with~~ for access selection ~~means~~ according to a third ~~exemplary~~ embodiment ~~of the present invention~~ suitable for vehicle scenarios;

Please replace the paragraph beginning on page 6, line 1 as follows:

Fig. 5 illustrates signaling flows ~~in~~ for current and future access selection according to ~~exemplary embodiments of the present invention~~an embodiment;

Please replace the paragraph beginning on page 6, line 4 as follows:

Fig. 6 illustrates ~~the~~ expected ~~behavior~~ behaviors in vehicular scenarios with access selection according to ~~exemplary embodiments of the present invention~~an embodiment;

Please replace the paragraph beginning on page 6, line 8 as follows:

Fig. 7 is a flow chart of an access selection method according to a first embodiment ~~of the present invention~~; and

Please replace the paragraph beginning on page 6, line 11 as follows:

Fig. 8 is a flow chart of an access selection method according to a second embodiment ~~of the present invention~~.

Please replace the paragraph beginning on page 6, line 16 as follows:

As mentioned in the background section, many communication systems of today comprise a plurality of access networks offering alternative access options for mobile terminals with the right capabilities. Such a multi-access communication system~~, in which the present invention can be used,~~ is schematically illustrated in Fig. 1. The illustrated communication system 100 comprises mobile terminals 110 with several access alternatives. The terminals 110 can use ~~either~~ any of the multiple access networks (ANs) 120 to reach IP-based network services 130, which are offered by content providers

150 (with associated data sources 151) over the Internet 140 or another packet based network. Examples of network services include content distribution network services with content caching, multimedia messaging services (MMS), voice over IP services, etc.

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Please replace the paragraph beginning on page 6, line 29 as follows:

The ~~present invention~~disclosed embodiments can be applied in connection with any mobile node/terminal 110 that has at least two access possibilities (also referred to as a multi-access terminal), such as two separate physical access network connections or one connection through which either of two separate access networks can be reached. The access network interfaces of the multi-access terminal can either provide direct external network access to the respective access network or network access via another device that belongs to the same PAN as the multi-access terminal. In the illustrated system 100, the multi-access terminals are represented by a laptop computer 110-1, cellular phones 110-2 and a personal digital assistant (PDA) 110-3.

Please replace the paragraph beginning on page 7, line 18 as follows:

~~The present invention~~An aspect of the disclosure focuses on how to select the best access network. Which access network that is best for the user in a particular situation depends on a number of factors, including:

Please replace the paragraph beginning on page 7, line 28 as follows:

As described in the background section, access selection in IP networks according to the prior art is generally *user-based*, i.e. the user decides what access network to use e.g. through a GUI, and/or *terminal-based*, i.e. the terminal selects an access network e.g. based on a default priority list, which is checked against currently available accesses. ~~The present invention instead proposes~~Instead, a method and architecture for *network-based* access selection in IP-based multi-access communication systems is proposed. Network-based access selection ~~basically means~~indicates that an entity in the network collects information and ~~tells~~ suggests the terminal in which access is the best.

Please replace the paragraph beginning on page 8, line 5 as follows:

The network-based access selection ~~of the invention~~ offers mechanisms by means of which the above-mentioned and other factors can be weighed together into an appropriate access network decision. As will be evident from the following description, even very complex access situations can be handled and the network-based access selection can ~~with advantage~~ be combined with terminal/user-based access selection to achieve a very robust system.

Please replace the paragraph beginning on page 8 line 13 as follows:

The functional architecture of the proposed new mechanism for access selection in multi-access IP networks is illustrated in Fig. 2. The illustrated

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~~exemplary~~ system 200 includes a mobile multi-access terminal /node 210 communicating with an Always Best Connected (ABC) service network 260 over an IP-based network 240, such as the Internet. The ~~exemplary~~ terminal 210 is equipped with a GUI 211 and associated with sensors 212 ~~for~~ to provide terminal-specific information related to for example position and velocity. The main access selection functions are performed by an access selection unit (also referred to as access wizard unit)261 and a profile server 262 at the network side as well as an access agent (also referred to as access wizard agent) 213, an access manager 214 and link managers 215 at the terminal side.

Please replace the paragraph beginning on page 8, line 26 as follows:

The access wizard unit 261 is a server unit/function arranged at the network side~~, which has~~ and plays a key role in the network-based access selection ~~of the invention~~. The access wizard agent 213 of the terminal 210 preferably signals information to the access wizard 261 about currently available access networks as well as current location, route and/or velocity of the terminal. The access wizard unit 261 then collects database information through the profile server 262, which provides a unified interface towards a number of databases 263. Based on the information from the profile server 262 and the access wizard agent 213, the access wizard unit 261 selects an access network (120 in Fig. 1) that is considered to be best for and thus ~~should~~ is preferred to be used by the terminal 210. This information is

signaled from the access wizard unit 261 to the access wizard agent 213. From there it is forwarded to the access manager 214, which ~~has means for executing~~ executes the actions necessary in order to use the best access.

Please replace the paragraph beginning on page 9, line 8 as follows:

An advantage ~~with the solution~~of the for network-based access selection ~~according to the invention~~ is that the major data transfer occurs on the network side (between the access wizard unit and the profile server) and normally does not have to rely on narrowband wireless links. Thereby, large quantities of database information can be handled. The data/information provided to the access wizard unit via the profile server can for instance refer to specific access networks, user devices, end users and/or operators. It typically includes information about access network availability, operator policies, operator/user prioritization criteria, as well as allowed user subscription profiles.

Please replace the paragraph beginning on page 9, line 19 as follows:

Through the profile server 262, the network access selection ~~mechanism of the invention~~ offers a most efficient solution for handling database information. For an appropriate access selection, the access wizard unit generally needs various types of information that is typically provided in many different formats and languages. ~~In accordance with the invention such~~Such

database information/profiles can be held in many different databases stored at different locations in the network. Before transmitting the respective pieces of database information to the access wizard unit, the profile server checks if they need to be adapted. If so, the profile server adjusts and/or converts the data such that it can be read by the access wizard unit.

Please replace the paragraph beginning on page 10, line 7 as follows:

In ~~a preferred embodiment of the invention~~an embodiment, the final decision as for which access network that is currently the best lies with the access manager 214. The access manager makes this decision based on information from the access wizard unit, preferably together with information input from the GUI (user intervention) and/or from a profile or priority list stored locally at the terminal. After determining which network is currently the best, the access manager provides corresponding instructions to the link manager(s). There are generally one link manager 215 for each access network interface of the terminal 210, ~~by means of~~ through which the terminal can be connected/disconnected to the respective access network. Another typical function of the link managers 215 is to detect available/current access networks and report this information to the access manager 214, from where it can be passed on to the access wizard unit 261 via the access wizard agent 213.

Please replace the paragraph beginning on page 11, line 23 as follows:

The network-based units for access selection ~~according to the invention~~ can with advantage be parts of an overall multi-access mechanism, such as an ABC service network that provides services related to mobility, security and access handling. The ABC service network is typically managed by a network operator, a mobile virtual network operator (MVNO) or a service/application provider, or provided in a corporate network. Other arrangements are possible, provided that the access wizard unit(s) and the profile server(s) are still network-based (arranged at the network side).

Please replace the paragraph beginning on page 12, line 23 as follows:

Fig. 3 is a schematic block diagram of a multi-access communication system with access selection ~~means~~ according to another ~~exemplary~~ example embodiment ~~of the present invention~~. Fig. 3 directly corresponds to Fig. 2, except ~~for the fact~~ that an application 317 on the terminal side and an application server unit/function 366 on the network side are shown. In accordance with this embodiment, the application server 366, which preferably is arranged in an ABC service network 360, collects/receives database information from the profile 362. The information is used to adapt the application 317 to suit the particular terminal/user. The application may for example be altered in response to the screen size of different user devices 310.

Please replace the paragraph beginning on page 13, line 1 as follows:

By adapting applications from the network side ~~according to the proposed new mechanism~~, many factors can be allowed to affect how the application is presented to the user. Another advantage is that transfer of unnecessary application information, i.e. information that the terminal cannot use, can be avoided.

Please replace the paragraph beginning on page 13, line 7 as follows:

Fig. 4 is a schematic block diagram illustrating access selection according to an ~~exemplary~~ example embodiment ~~of the present invention~~ suitable for vehicle scenarios. In this example system 400, Mobile IPv6 [4] is used for mobility management between a vehicle terminal 410 and an HA 465 located at an MVNO ABC network 460. The security function of the ABC service network 460 comprises an AAAh server 464. The AAA infrastructure for seamless mobility and the mobility client of Fig. 4 can for example correspond to the collection of AAAv and AAAh as described in Diameter MIPv4 application [5].

Please replace the paragraph beginning on page 15, line 16 as follows:

The network-based access selection procedure of the access wizard unit 461 can either be initiated through a request from the access wizard agent 413 in the terminal 410 or be initiated by the access wizard unit itself. In ~~a~~

~~preferred~~an embodiment ~~of the invention~~, the acccss sclection algorithm is executed every time the environment changes, such as when another access network becomes available/unavailable, or applications start/stop. Thereby, the best access network is updated to suit the new situation.

Please replace the paragraph beginning on page 16, line 15 as follows:

Predictive access selection ~~requires~~ indicates that the access wizard unit 461 receives some kind of indication of where the user is heading, such as the planned route or the current direction and speed of the mobile terminal 410. Since users in vehicles 418 normally are confined to certain locations (roads, garages, etc.) and are associated with predictive certainties as for the chosen route, direction and speed of the vehicle, predictive access selection works especially well for (but are not limited to) vehicle scenarios.

Please replace the paragraph beginning on page 16, line 23 as follows:

According to ~~a preferred~~an embodiment, the access wizard unit 461 also assists the security mechanism, e.g. the AAA infrastructure, in order to achieve seamless mobility. More specifically, the access wizard unit issues the necessary triggers for AAA inter-domain security context transfers. In Fig. 4, it is shown that the access wizard unit 461 sends a triggering message to the AAAh 464. In response to this trigger, the AAAh 464 provides transfer of the necessary security context from the AAAv 471 in the security domain 470 the

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vehicle 418 is about to leave to the new AAAv. In this way, the new AAAv is prepared for the fact that the mobile terminal 410 will soon be entering its security domain, whereby AAA optimization for fast handoffs can be achieved.

Please replace the paragraph beginning on page 17, line 1 as follows:

The access wizard unit can issue the necessary triggers for inter-domain transfers of security contexts in connection with both the current access selection and the predictive access selection. The predictive access selection might often result in AAA optimization with even smoother handoffs. Fig. 5 illustrates network-based current access selection and predictive access selection, respectively, according to ~~exemplary~~ example embodiments ~~of the present invention~~. Exemplary signaling flows are shown for the current access selection, with handoff from an access network assigned under AAAvO (not shown) to an access network assigned under AAAv1 571-1, and for the predictive access selection, with further handoff from the access network assigned under AAAv1 571-1 to an access/cell assigned under AAAv2 571-2.

Please replace the paragraph beginning on page 18, line 11 as follows:

Furthermore, there may be cases where the access wizard unit during the predictive access selection process realizes that no suitable access is available to support the requirements of the subscriber/application/terminal for the given route. In accordance with another embodiment ~~of the present~~

~~invention~~, the access wizard unit in such situations suggests an alternative route, such that there will be less or no service disruptions. This is referred to as *proactive access selection*.

Please replace the paragraph beginning on page 19, line 4 as follows:

Like the predictive access selection, the proactive access selection ~~requires~~ indicates that the access wizard receives some kind of indication of where the user is heading. Accordingly, the proactive access selection is particularly advantageous for vehicular scenarios. Generally the current chosen route is given, but in some cases, e.g. some vehicular scenarios, the access wizard may be able to conclude where the user is going by just knowing the current location (and preferably also the direction and speed).

Please replace the paragraph beginning on page 19, line 12 as follows:

Fig. 6 illustrates ~~the~~ expected ~~behavior~~ behaviors in vehicular scenarios with the current, predictive and proactive access selection according to ~~exemplary~~ the example embodiments ~~of the invention~~. The expected ~~behavior~~ behaviors for the current and predictive access selection ~~is~~ are demonstrated in *A*. The vehicle chooses high-priority allowed access networks/cells (solid) when available; low-priority allowed access (dashed) when high-priority access is not available, and avoids the non-allowed areas (dotted). *B* illustrates the expected behavior for the proactive access selection. Solid, dashed and dotted lines,

respectively, still means high-priority, low-priority and non-allowed access networks, respectively. When neither high-priority nor low priority allowed accesses are available along the chosen (current) route, an alternative route is suggested such that the coverage is not interrupted. The vehicular application of the proactive access selection may for example be implemented together with a car navigation system.

Please replace the paragraph beginning on page 19, line 27 as follows:

The solutions described with reference to Figs. 4-6, especially ~~those~~ for the predictive and proactive access ~~selection~~selections, have primarily been exemplified by and are especially advantageous for situations where the mobile multi-access terminal resides in a vehicle. Nevertheless, it should be understood that scenarios involving other mobile terminals than those in vehicles also lie within the scope of the present invention. The proposed solutions can be used for handling access selection, mobility and security for any mobile multi-access terminal.

Please replace the paragraph beginning on page 20, line 4 as follows:

~~Methods according to the present invention~~Example methods for the current access selection and for the combined current, predictive and proactive access ~~selection~~selections, respectively, are summarized by the example flow charts of Fig. 7 and Fig. 8.

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Please replace the paragraph beginning on page 20, line 8 as follows:

Fig. 7 is a flow chart of a method for the current access selection according to ~~a preferred~~an embodiment ~~of the invention~~. In a first step S1, the network-based (i.e. arranged at the network side) access selection unit (access wizard unit) receives terminal-specific information from the access agent (access wizard agent) in the mobile multi-access terminal. The access selection unit then collects database information in a step S2 by requesting and receiving data/information/profiles from a profile server, which is associated with a (typically large) number of databases. Based on the information from the profile server/databases and access agent, the access selection unit selects a current best access network for the terminal in a step S3. This can for instance involve executing an access selection algorithm based on predefined prioritization criteria at the access selection unit. In a final step S4, an access network recommendation comprising the current best access network is communicated from the access selection unit to the access agent. Depending on the implementation, the terminal can be forced to always follow the access network recommendation from the access selection unit, or it can use the recommendation as basis for a final access network determining process at the terminal. In the latter case, the network-based access selection at the access selection unit supports the final access selection decision of the terminal.

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Please replace the paragraph beginning on page 20, line 29 as follows:

Fig. 8 is a flow chart of a method for combined current, predictive and proactive access selection according to another ~~preferred~~ embodiment ~~of the invention~~. The terminal-specific information from the access agent in the first step S1 includes the current (chosen) route for the mobile terminal. The steps S2 to S4 are performed as described with reference to Fig. 7. In a step S5, the access selection unit determines future access candidates, i.e. the access networks that may be possible after a predetermined period of time. Hereby, the access selection unit can for example produce a list of the future access candidates. The access candidates are checked against prioritization criteria and step S6 asks if there are (possible/allowed) candidate access networks available in the current route. If at least a portion of the current route lacks matching candidate access networks, the access selection unit suggests an alternative route for the terminal in a step S7. The alternative route is communicated to the access agent of the terminal in a step S8. This may be achieved in a simple manner by displaying the possible access network areas on a map. Should there, on the other hand, be candidate access networks available in the entire current route one or more future best access networks are selected at the access selection unit in a step S9, preferably by running a prioritization program/executing an access selection algorithm. In a final step S10, an access network recommendation comprising the future best access network(s) is communicated from the access selection unit to the access agent.